5 FACILITIES:

5.1 Description of Rearing Facilities – The District designed the Facility in the early 1990s to hold juvenile steelhead rescued from the lower Carmel River during the summer. The Facility area occupies a broad flood-plain terrace bench above the river at elevation 401 feet above sea level, covering approximately seven acres (**Figure 5-1**). A mature canopy of coast live oak (*Quercus agrifolia*), local topography and several large California sycamores (*Platanus racemosa*) shade the site. Streamflow at the site is perennial, and augmented during the dry months by releases from Los Padres Reservoir. The Facility improvements cover approximately 9,300 square feet (ft^2) of land, including 480 ft^2 for the storage/office building, 2,400 ft^2 for rearing pools, and 6,400 ft^2 for a rearing channel. The single-story office, lab, and storage building is located adjacent to the tanks and rearing channel. Construction of the Facility began in 1995, was completed in 1996 and the first fish were received in late 1996.

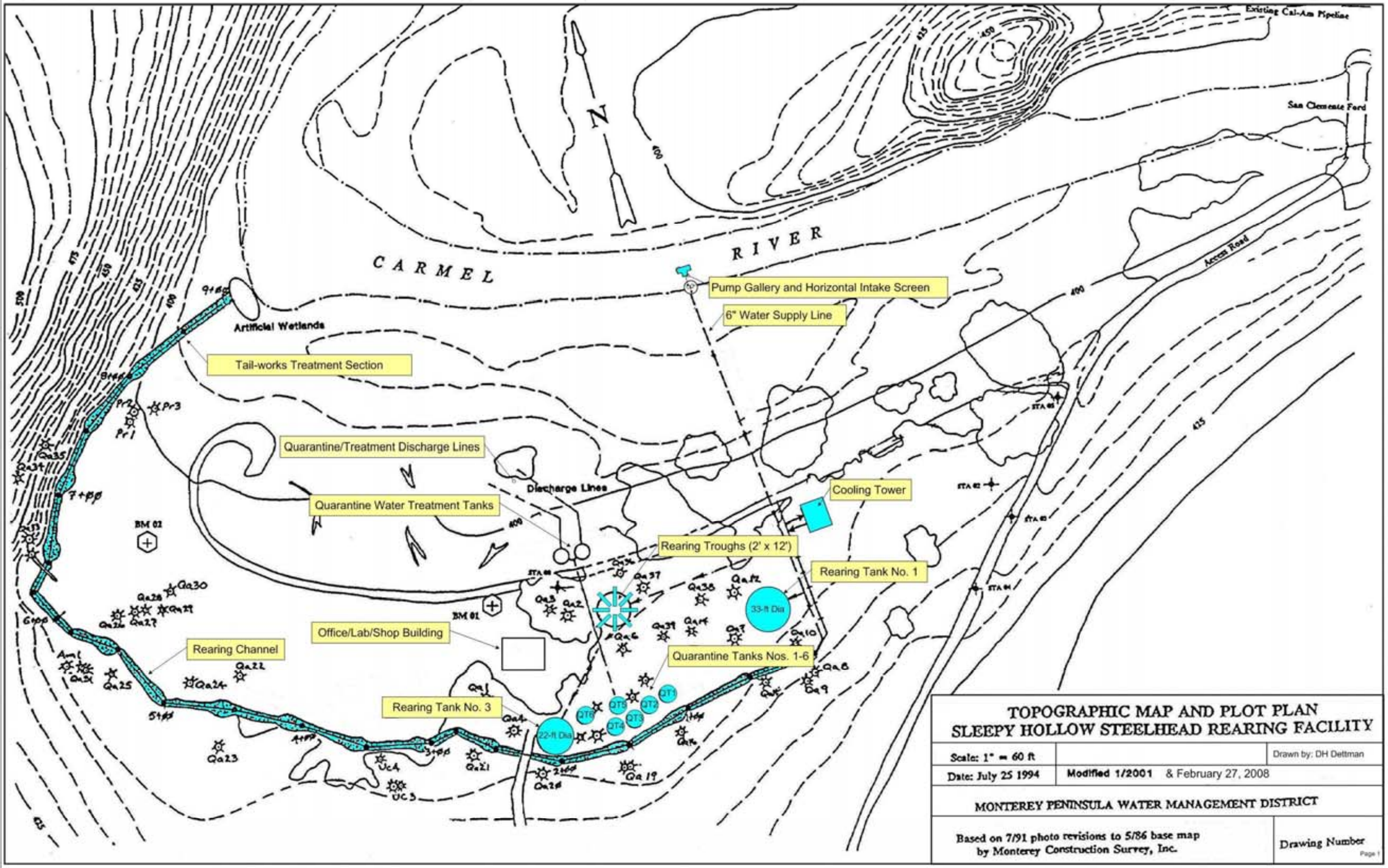
The design includes a screened freshwater intake, located on the riverbank at a large pool adjacent to the Facility and approximately 250 feet of 6-inch diameter PVC pipe to deliver water to the rearing facility. The intake system delivers up to 900 gallons per minute (gpm). A portable irrigation pump provides an auxiliary backup water supply of 500 gpm.

With an estimated capacity of approximately 64,000 YOY juvenile fish, the rearing units include an 800-foot-long naturalized rearing channel, two large holding tanks (22 and 30 foot diameter), eight insulated fiberglass rearing troughs, and six 8-foot diameter quarantine/holding tanks.[1]

Generally, the Facility operates from early summer to late fall/early winter depending on river flow and weather conditions. Once flow returns to the lower river, District staff recaptures, counts and releases the fish back into the river.

[1] The channel and tanks were originally sized to hold and rear a maximum of 64,000 wild YOY and juvenile steelhead to a weight of about 13 grams through October 15 of each year. Based on experience during the past nine years, this RRMP anticipates downsizing the initial stocking capacity to approximately 36,200 juveniles, including 8,450 fry, 23,700 fingerlings, and 4,050 yearlings. (see Chapters 7 and 8 for a detailed description of capacities and expected numbers of stocked juveniles)

Figure 5-1 Rescue and Rearing Management Plan



The following sections describe details of the mechanical-electrical components and equipment:

5.1.1 Pumps: There are six permanent water pumps at the Facility (P1, P2, P3, P4, P5 and a small booster pump), and one large portable, emergency river pump (P6).

5.1.2 River Pumps (P1 and P2) – Two large, 30 horsepower (HP) PACO pumps (Model # 51-41211-5882, Serial #s 00010293A & 00010293B) located in the pump galley adjacent to the river, supply all the water for the Facility (**Figure 5-2**). The river pumps are size to provide a maximum flow of 900 gallons per minute. Water flows under gravity head pressure into a wedge-wire drum screen in the middle of the river channel and through a 10-inch diameter pipe into the gallery (**Figures 5-3 and 5-4**). Once in the gallery, water is pumped under the cobble bar in a six-inch diameter PVC pipe to an underground vault fitted with a water meter, meter bypass circuit and hand-valve controls. A standby replacement P1/P2 pump is in storage (PACO Pump Model #P25C2704L, SN#).

Figure 5-2 River Pumps Nos. 1 and 2

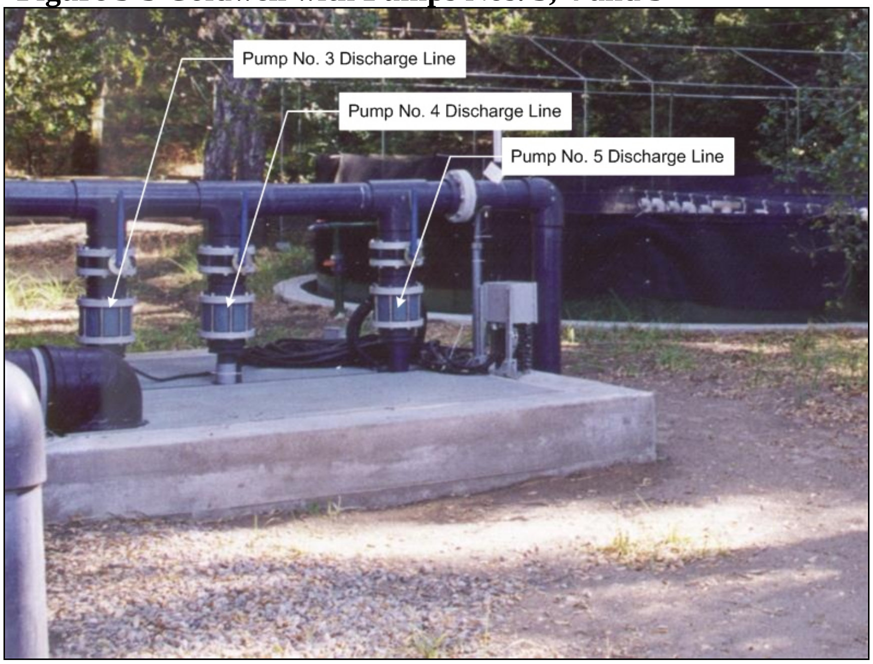
Figure 5-3 Adjustable River Intake Screen

Figure 5-4 Intake Gallery at High Flows (about 750 cfs)

5.1.3 Cold Well Pumps (P3, P4, and P5) – There are three pumps positioned in the cold well that receive water from the cooling tower - two smaller, 7.5 HP, cast iron pumps (P3, P4), and a larger 10 HP, variable-speed pump (P5). P3 and P4 operate automatically on an alternating weekly schedule (**Figure 5-5**). One of the two is always on. The District replaced these pumps in July 2001. A standby replacement P3/P4 pump is in storage (Tsurmi Pump Model #KRSZ-B4 7.5 HP, 1720 RPM, 3PH/230V).

P5 operates full time, but the amount of water it pumps varies constantly depending on the water level in the cold well that is maintained within a predetermined range. The District replaced P5 in September 2003 after the pump failed due to water entering the outer seal of the pump. A new PACO Pump #51-49513-5782, 230 V 10HP with Tungsten Carbide outer seals was purchased from Alsop Electric Motor shop in Salinas and the original P5 was rebuilt as a backup (PACO Pump MODEL P21G2701, ID# 05MX212701).

Figure 5-5 Coldwell with Pumps Nos. 3, 4 and 5



5.1.4 Portable Emergency Pump (P6) – As part of its Interim Sediment Retrofit Project in 2003, the District purchased a Gorman-Rupp portable pump (Model T4A3S-B) to use when high bed load and suspended load movement jeopardizes the use of P1 and P2. This pump sits on a gravel pad adjacent to the pump galley during operations (**Figure 5-6**). A 6-inch hose and portable pipeline connect the pump to the intake of centrifugal separator or bypass inlet to the cooling tower.

Figure 5-6 Auxiliary Backup Pump

The District replaced the rotating assembly (impeller, seals, shaft, and housing) in 2003 after pumping at low discharge rates damaged the impellers. A spare rotating assembly is stored in the shop.

During fish removal operations in the fall/winter period, the District uses the P6 pipeline to supply low water inflow rates to the rearing channel. During this period, excess flow from P1/P2 diverts backwards through the 6-inch pipeline and discharges onto the cobble bar.

During the winter, the District stores P6 and the portable pipeline near Tank 1 safely away from high river flows.

5.1.5 **Booster Pump –** To supply domestic water for the office/shop/lab, a small booster pump pressurizes filtered river water from the supply line and pumps the filtered water up the back hill to an upper 200-gallon primary settling tank. The pump is located behind the office building under a protective wooden structure. The booster pump starts/stops automatically as controlled by a floating ball switch in the upper settling tank.[2] Water pressure in the pipes must remain high enough for the booster pump to turn on. This may require "necking down" the head-works valve on the rearing channel slightly to increase the system's water pressure.

5.1.6 **Cooling Tower –** Following the 1997 rearing season, when high water temperatures compounded by severe *Ichthyophthirius* and bacterial infections caused excessive mortalities, the District convened two

[2] The upper tank serves to settle any fine suspended particles. Once settled, water flows via gravity differential pressure into the lower 1,400-gallon treatment storage tank where continuous treatment with dissolved ozone kills bacteria. Water then flows via gravity pressure into the office/lab/shop building. No interconnection is possible between the domestic water system and other facility supply, except outside the office building where a 2-inch gate valve is permanently shutoff.

Interagency-stakeholder workshops in November 1997 and November 1999. As a result of these workshops, an extensive engineering feasibility study and consultations with the California Department of Fish and Game and NOAA Fisheries, the District installed a cooling tower in 2000 to reduce the temperature of incoming river water (**Figure 5-7**). The tower handles a maximum flow of 900 GPM and the design goals are to keep maximum daily water temperature less than 70° F and maintain mean daily water temperatures below 65° F. Within the tower, warm river water sprays over and drips through a stack of plastic media trays, as a large fan pulls dry air from the bottom of the tower up through the dripping water. As the dry air passes through the dripping water, a small portion of the water evaporates, saturating the incoming air and cooling the remaining water in the process. While the incoming water always passes through the tower, the fan only operates when the river water exceeds 59 °F. A backup 30-HP fan motor and replacement fan belts are kept on site.

Figure 5-7 Cooling Tower

5.1.7 Quarantine System – Oftentimes, District staff and CRSA volunteers rescue steelhead from areas where water quality conditions are poor and pathogens infect the rescued fish. To help reduce the risk of passing infections from newly rescued fish to fish already stocked in the Facility, the District operates a quarantine system. Constructed in 1999, the system consists of five, 8-foot diameter x 3.5-foot deep insulated tanks displacing approximately 1,200 gallons (**Figure 5-8**). Each tank has its own water and air supply line and recirculation chiller that can further reduce and maintain the tank water temperature to lessen fish stress and disease. The chillers are capable of maintaining temperatures as low as 50 °F with typical inflow rates of 5-10 gallons per minute. Two additional tanks (8-foot dia. x 3.5 feet deep and 4-foot dia. x 2.5 feet deep) are located adjacent to the quarantine system and are used to hold fish for short periods of time or while fish are tallied. Each is fitted with water and air supply lines.

Figure 5-8 Quarantine Tanks, Loading Dock and Safety Platform

Discharge/Testing of Treatment Water: Water from the quarantine system, not used in the treatment of fish, (i.e., contains no chemicals) is discharged onto the cobble bar where it percolates into the shallow groundwater adjacent to the Facility. District staff discharges treatment water containing formalin or antibiotics into a pair of 8-foot diameter holding tanks and treats the formaldehyde-laden water with ozone for three or more days to oxidize the residual formaldehyde into formic acid, carbon dioxide and water. Once treated, the District discharges the water onto the cobble bar.

5.5.8. Blowers and Air Filtration System – Two 3.5 HP Sweetwater regenerative air blowers, one "normally on" and one on standby, operate continuously to supply filtered air for the entire Facility. The normal air pressure in this system runs at about 48" of water pressure, or approximately 1 psi; a blow-off relief value located on the air discharge line maintains the air pressure. The pressurized filtered air flows to the head of the rearing channel and each pool.

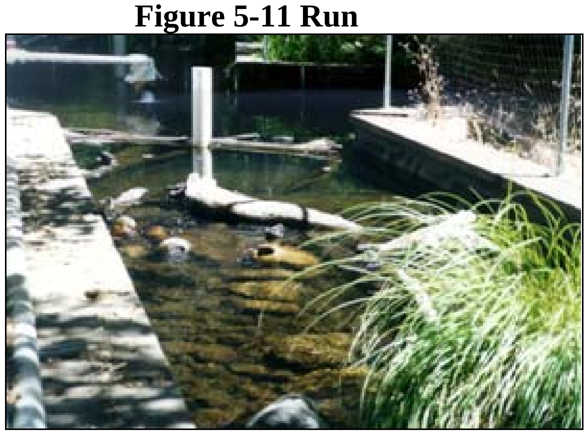
5.5.9. Rearing Channel – The Facility features an 800-foot long rearing channel winding along the base of a steep, north-facing hill, under a dense canopy of mature coast live oaks. The design of the rearing channel simulates a natural environment with seventeen (17) pools interspersed between riffles and runs with the bottom covered in a layer of cobbles, boulders and large gravel (**Figures 5-9 to 5-11**). Nominal depth of the channel is three feet;

actual depth varies from 2.5 feet in pools to about ¼ foot in the shallowest riffles. Each year, the District adds assorted large and small woody debris and dried Christmas trees to provide additional habitat complexity. Channel slope averages ½ percent (0.5-foot fall per 100 lineal feet of channel). At this slope, velocity varies from near zero in the pools to 2 feet per second in the shallowest riffles. The channel is fitted with a horizontal, rotating drum screen at the end to prevent fish from uncontrollably migrating out of the Facility.

Figure 5-9 Riffle

Figure 5-10 Pool

Figure 5-11 Run



Filtered air from the blowers flows into a 6-inch PVC pipe that runs along the top edge of the channel branching off at each pool, where a 2-inch pipe supplies clean air to a series of water filters. Most pools in the channel are fitted with an 8-foot x 4-foot filter bed comprised of a redwood frame covered by filter fabric, a stainless steelhead grate and a foot-thick layer of gravel. The filters in the lower five bays have been modified by filling the frames with mesh bags of bio-balls (plastic media) then covering those with a sheet of Vexar. The gravel layer has been removed. Under the screen, pumped air discharges through a silica diffuser at the base of a 6-inch diameter riser. The riser connects to a 4-inch perforated PVC-manifold in the filter box. In operation, water draws downward through the gravel media and into the manifold, flows upwards into the air riser, and discharges back into the channel at the top of the riser. Bacteria within the gravel break down the waste into harmless byproducts. This process improves the water quality in the channel by filtering fish waste products and excess food from the water, stripping CO_2, adding oxygen and circulating the water column.

Below the 800-foot main section of the channel, the District constructed a special 100-foot long tail-works section consisting of eight bays filled with plastic Bioballs® or red lava rock (¾-inch size). The tail works function as a final biological filter for all the water leaving the facility, prior to discharge back into the river, approximately 300 feet downstream of the intake diversion.

In spring 2005, the District installed a series of 14 two-piece plywood weirs at the downstream end of the pools. The top piece is fitted with plastic mesh to allow water to pass, but blocks fish movement. The weirs allow staff to segregate fish by rescue period, method, and size, effectively creating 15 separate rearing areas within the channel. In winter 2005, staff discovered that many of the smaller, young-of-the-year fish had moved from the lower bays to the upper bays in the rearing channel. This complicated accounting for survival percentages in each bay. After the staff decommissioned the channel for the off-season, they discovered gaps under the new weir boards. To prevent fish movement in the future, staff filled the gaps with non-toxic caulking. This has the added benefit of waterproofing the weirs, thereby adding an additional backup mechanism to prevent acute dewatering of the rearing channel, if the river pumps fail. In this configuration, the channel holds more water for a longer period without inflow, thereby giving staff more time to correct the problem without fish losses.

District operates a series of feeding stations along the channel, including automatic belt feeders and Sweeney vibratory feeders; and supplements this system with daily hand feeding throughout the channel.

5.5.10. Tanks – The Facility includes two large above ground circular rearing tanks (22-foot or 30-foot diameters) (**Figure 5-12**). Valve-controlled water and air flows independently to these tanks and each tank is fitted with a central overflow standpipe to control water volume. Currently, these tanks cannot be run effectively if the rearing channel, quarantine tanks and rearing troughs are running at full flow, as the Facility inflow is insufficient for concurrent use of all the rearing containers. If needed, these tanks could be fitted with a water filtration and recirculation system to expand capacity.

Figure 5-12 Rearing Tank No. 1

5.5.11. Fish Rearing Troughs – In Spring 2006 staff demolished one of the original 22-foot diameter tanks (Tank 2) and reconstructed the site into a series of eight rearing troughs (**Figure 5-13**). Each trough is a 2-foot x 2-foot x 10-foot, 200-gallon insulated tank, fitted with an overflow standpipe, independent inflow control valves, and a filtered air source. Two tanks have a chiller in place to help reduce water temperatures. The District is investigating the feasibility of adding chillers to the remaining tanks and outfitting all the tanks with filtration and recirculation units. The purpose of these smaller tanks is to provide a controlled environment for holding initial groups of fry and small fingerlings.

Figure 5-13 Rearing Troughs

5.5.12. Monitrol and RACO Alarm Systems – Two electronic modules provide automatic operational control of the water supply at the Facility including the Monitrol Controller and the RACO Alarm:

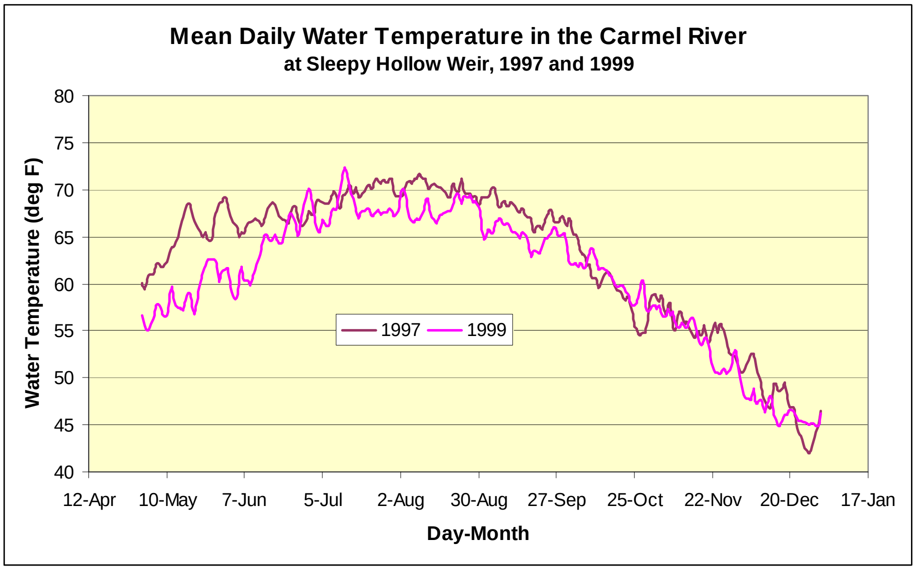
Monitrol – Monitrol is an electro-mechanical control system designed specifically for the aquaculture industry. It is comprised of a computer program and digital/analog circuits that controls operation of automatic water pumps and the cooling and monitors sensors for temperature, oxygen concentration, water levels in the pump gallery and cold well, and facility inflow from the river pumps. The oxygen and water temperature data is logged and recorded to a data file for later retrieval. Spare probes and sensors for the water level, oxygen and temperature are kept on-site for rapid replacement.

RACO – The RACO alarm system interconnects to the Monitrol system. The District installed it in 2002 to improve monitoring capability and provide an alarm system for important electro-mechanical components. The RACO alarm connects to a staff list via the ATT phone system and District staff remotely monitors status of the water pumps and electrical power system. The RACO system automatically notifies key District personal by phone in case pumps Nos. 1-5 malfunction, inflow rates decline, water levels in the cold well or pump gallery drop below established set points, or the PG&E power system is offline.

5.2 Acclimation/Release facilities – The District can release fish in two ways, by volitional migration out of the rearing channel or by capturing fish, placing them in transport tanks and releasing at various points in the river downstream of the Facility. During volitional releases, the District raises the horizontal drum screen or fixes it in position and tallies the number of fish passing mid-way down through the tail works and into a small trap. After counting and weighing the trapped fish, staff releases them into the river below the tail works. If fish need to be removed on a set schedule, staff captures fish in the rearing channel first by pulling small seines through the channel with multiple passes and finally by electrofishing in each of the channel sections. Depending on the numbers of fish in the channel, active removal of all the fish takes four to eight weeks. During active removals, all fish are counted, placed into 5-gallon buckets and transferred to portable 125- or 300-gallon transport tanks throughout the day. At the end of each day all of the fish captured that day are transported and released downstream of the Facility. This latter release method has been used for the last four years, and will be the primary method in the future.

5.3 Describe operational difficulties or disasters that led to significant fish mortality – As mentioned in Section 5.5.6, river water temperatures in the Carmel River at Sleepy Hollow often exceed levels that are considered suitable for juvenile steelhead, let alone acceptable for rearing juvenile fish under high population densities in an artificial setting. Based on experiences in 1997 and 1999, it became obvious that water temperatures needed to be reduced or limited in some fashion because the high water temperatures, combined with an infestation of *Ichthyophthirius sp.* and bacterial infections, cause unacceptable losses. Following the floods of January and March 1995 and January 1998, and prior to construction of the cooling tower in 2000, mean daily water temperatures often exceeded 65 ° F and ranged into the low to mid-70 ° F range (**Figure 5-14**).

Figure 5-14



San Clemente Reservoir is nearly filled with sediment and since 2002 the California Division of Safety of Dams has required that CAW lower the reservoir during the summer months to temporarily reduce the risk to downstream properties and persons from a dam failure during this time. This situation jeopardizes continuous operation of the water intake system at the Facility because fine-grained sediment enters the intake and damages pump seals, thereby increasing the risk of catastrophic pump failure. Section 4 of this RRMP provides an updated description of this problem and potential solutions.

5.4 Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality:

Since 1999, the District has implemented the following risk aversion measures to reduce risk of catastrophic losses at the Facility including:

- Quarantine System for Treating Incoming Rescued Fish (1999).
- Permanent Bird Netting Exclusion Rearing Channel and Tanks (2000).
- Cooling Tower to reduce water temperature and aerate the water supply (2000).
- Installation of the RACO automatic alarm system to provide remote monitoring of key equipment (2001).
- Installation of Larger, Improved Emergency Standby Backup Generator (2000)
- Interim Sediment Retrofit Project with improved seals for water pumps, a sand-sediment separator and a new backup river pump (2002).
- Installation of weir plates in the rearing channel to help prevent and delay dewatering of the channel, and improve size segregation of fish to reduce intra-

specific competition and predation (2005).

- o Addition of re-circulating canister and biological filtration system to Rearing Tank #3, to run it in isolation from the river on an ongoing basis, if needed during turbid winter flows (2008)
- o Addition of re-circulating canister and biological filtration system, and cooling coils to Rearing Troughs #1-8, to enhance fry survival, and run in isolation from the river for short periods of time, if needed during turbid winter flows (2009).